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study are needed; and when we ascend to the highest product of evolution, the cortex of the human cerebrum, we are presented with the most interesting as well as with the most baffling aspect of the problem. A combination of methods, applied with patience and ingenuity, has divested the problem of some of its mystery. By co-ordinating the symptoms during life with the lesions revealed in the post-mortem examination; by exposing the brains of the lower animals to definite injuries, and carefully recording the results; by removing certain sense-organs or other parts in developing animals, and observing the defects of organization in the adult; by utilizing the exceptions that nature presents, — we have acquired a knowledge of the laws of the nervous system that would have seemed Utopian to our fathers, and that has already enabled the surgeon to predict the location of and remove a tumor in the brain.

The study of the senses has acquired a deeper and a richer meaning since the recognition of its place in a forming science has come about. The revolutionary discoveries of Helmholtz, whose success is so largely due to the union of two sciences, have induced others to continue the work in a hundred directions; and as indicative of the promise that these researches hold out, may be cited the conviction of an eminent physicist, Professor Mach, that the next great movement in the progress of science must come from the union of psychological points of view with physical methods and results. A mere mention of the many investigations that owe their origin to the work of Fechner and the formulation of his psycho-physic law must suffice to indicate the great activity in this field, and to justify the title of an experimental psychology. Moreover, the measurements of the time taken up by various psychic processes, the experimental study of memory, of attention, of the association of ideas, of the bilateral functions, of rhythm and the time-sense, of space and time perceptions, and so on, have led to the development of a mass of ingenious apparatus, and have made the psychological laboratory an indispensable requisite for its satisfactory instruction.

Morbid psychology is a rubric of paramount importance to the full and clear comprehension of the phenomena of mind. The genesis of illusions and hallucinations, the perversion of the natural channels of the emotions, the disintegration of the elements of personality, the dissolution of the logical powers, — all these problems transform the apparently wild and chaotic picture of the mad-house into a sad but interesting record of the process of character and of mind building. This interest is heightened by remembering that here lies the key to the understanding of the psychic epidemics that in the past have upset the rationality of mankind, and transformed the incoherent babbling of some demented soul into the mysterious utterances of a revealed spirit. It is furthermore heightened by the notice that the phenomena conveniently grouped as 'psychic research' are attracting, and always will attract. Hypnotism, after an adventurous and uncertain existence in the hands of charlatans, has been admitted into science; and although the literature of the topic, at least in France, is increasing out of all proportion to our insight into the nature of the phenomena, yet enough has been established to recognize in this semi-morbid condition the key to the solution of many otherwise barely accessible problems. With regard to those borderland phenomena, — 'telepathy,' 'clairvoyance,' and the like, — they illustrate the subtleness of the process by which false systems gain success, and demonstrate the advisability of having men who can speak on such topics with the authority of trained experts.

What its votaries have deservedly dignified into the science of 'anthropological psychology' offers a most attractive field for research. The customs and thought-habits of primitive peoples not only record the first stages in the progress that leads to culture, but prevent the formulation of notions that seem true enough when tested by our own civilization, but reveal the provinciality of their origin when applied to more rudimentary conditions of life. Instead of *résumé*-ing the many rubrics that here contribute to the completeness of a scientific psychology, one may refer to the works of Mr. E. B. Tylor as exemplifying at once the attractiveness of the subject, and the value of the results, under a learned and skillful treatment.

If we conclude this survey with the mention of the psychology of the developing child, glimpsing as it does, in the budding capabilities of the infant, the microcosm of the race and an epitome of the

struggle for civilization, it is not because the lines of research have been exhausted, but that, with the scope of the science thus outlined, what remains to be done will probably be suggested by what has been said. The psychology of the infant is not the only point at which psychology and education touch; but everywhere education must refer to psychology, of which, in the highest sense, it is only the practical application.

The movement has not been without its opponents. The cry has been raised that it is not a science, but a mere aggregation of disjointed facts: it shines by borrowed wealth. But the force of this objection is weakened, if we remember that a science maintains its individuality quite as much by the point of view from which it regards its subject-matter as from the nature of the subject-matter itself. It is not an evidence of weakness for one science to borrow from and build upon another; but it testifies to the unity of the phenomena of nature, and reduces the division of the sciences to what they at bottom represent, — the classification of the direction of men's interests. The chaotic condition of the facts with which psychology deals is rapidly disappearing, and it may yet hope to receive a unifying impulse such as Darwinism gave to zoology. It is, at all events, better to have a collection to arrange when the true method of arrangement shall be discovered, than not to collect because the ideal arrangement is not yet at our service.

Again: there are some, who, heedless of the caution of George Henry Lewes, — that the first question is not, "What does it lead to?" but, "Is it true?" — see in the objective study of mind the downfall of idealism, and of all the valuable beliefs that have clustered about it. They stigmatize it as materialistic. This is surely a misunderstanding. The history of the movement does not bear out such an accusation. The men the spirit of whose work is in line with a scientific psychology — Lotze, Helmholtz, Fechner, Wundt — are all of them the very opposite of materialists. The new movement does not attempt to usurp the place held by other studies, except as it is an advance upon them: it does not pose as the only department of philosophic learning. Its professors have fortunately been men of liberal sympathies, and deeply imbued with the historical sense. They do not claim to have created a science entirely new, unique, and undreamt of, but appreciate their development from the past. Their aim is to retain for the study of mental science that high place which has always been accorded it, by making it progressive and abreast of modern learning.

Professor Ribot, in the opening lecture of his course at the Collège de France (*Revue Scientifique*, April 14), taking a bird's-eye view of psychological activity in the various countries of civilization, saw everywhere signs of great promise. The literature is increasing both in value and in quantity. The science has reached the 'monograph' stage. Journals specially devoted to its interests, such as the *Philosophische Studien*, the *Revue Philosophique*, the *Rivista di Filosofia Scientifica*, and our own *American Journal of Psychology*, are flourishing; and laboratories and professorships for the dissemination of its teaching are being established at the leading universities. With the advantages that the youth and plasticity of our educational institutions give them, and the successful examples of the leading universities before them; with the practical ends that the new movement embraces; and with our pushing enthusiasm to have every thing that is new and good, — it seems justifiable to predict for scientific psychology a large and representative following in this country. JOSEPH JASTROW.

ABORIGINAL ARCHITECTURE IN THE SOUTH-WEST.

A FIELD-PARTY of the Bureau of Ethnology, in charge of Mr. Victor Mindeff, has recently returned to Washington, bringing a large amount of new and valuable material. For a number of years past Mr. Mindeff's investigations have been confined to the architecture of the South-west. One of the most interesting places visited by him during the past season was a group of cave-dwellings situated about eight miles north-east of Flagstaff, Arizona. These ruins had previously been visited by Major Powell and Mr. Stevenson.

The remains occupy the summit of a cinder cone, and extend some distance down the south side. The rooms are numerous,

and are excavated in the top and sides of the cone, forming rough, dome-shaped cavities, with an opening for ingress in the rounded or flat top of the dome. These cavities are densely grouped on the summit of the cone, and more scattered lower down. Halfway from the summit to the lowest level of occupation were found traces of a continuous rampart wall.

Large lumps of the porous substance composing the hill had been removed to form the chambers, and piled up outside, forming rude walls enclosing the openings. Some of the chambers are quite small, and were probably used for storage, as the only means of access to them is through the larger rooms. The floor-levels vary considerably: many of the storage-rooms are several feet higher or lower than the connecting large room. This difference in floor-level is in some cases the result of an effort to conform to the topography of the site.

The entrances are usually much broken away, but were probably rectangular. In several cases a rectangular niche or channel, forming part of the entrance-opening, was seen, occurring sometimes in the centre, sometimes at one end of the side of the same. These channels may have served as chimneys, as there is considerable evidence of smoke-blackening in the recesses, as well as on the roof of the cavities. An abundance of fragments of metates was found, of the massive type which occurs in the vicinity of Globe, and also some complete ones. Upon the upper part of the cone a considerable number of potsherds were seen, all the fragments quite small.

Some cliff-dwellings in Walnut Cañon, about twelve miles southeast of Flagstaff, Arizona, were examined. The ruins are quite small, rudely and carelessly built, and suggest occupation by a small community and for a short time. They are distributed over several ledges of the cañon at varying heights from the stream-bed below. At the time of the visit the bed of the stream was dry. Above, adjoining the cañon brink on the north, occur several clusters of rooms which probably had some connection with the cliff-dwellings. Two piles of stones — the remains of rude walls — were seen at a distance of three or four miles from the cliff-dwellings. They seem to be the remains of single rooms. Similar vestiges were found at points north of the vicinity of the cave-lodges above described.

In the vicinity of Keams Cañon, Arizona, an extensive group of ruins was examined, occurring along the north border of the Jeditoh valley, on an escarpment overlooking that valley. There are seven ruins in the group, so far as known, distributed over an extent of twelve miles. The westernmost and largest ruin is known as Awatobi, or under its Navajo name of 'Talla Hogan.' It has been often visited by parties of the Bureau of Ethnology and by others, and has been identified as the Aguatobi of Espejo's narrative (A.D. 1583). It was occupied only a short time after Espejo's visit. The whole group of ruins is directly connected by tradition with the present inhabited villages of Tusayan (Moki), having been built and occupied by gentes whose descendants constitute a portion of the present Shimimo Indians. Awatobi is an extensive ruin, and others of the group are but little inferior in size, though in the latter, as a rule, no standing wall remains. The direction and distribution of the walls can, however, be easily traced. All the ruins of this group occur on the immediate edge of the escarpment, and overlook wide areas of valley-bottom, including fine stretches of cultivable land.

The party afterwards camped for some time in the vicinity of Oraibi, the westernmost and largest of the present villages of Tusayan. The work here was a continuation of the work of a party which visited Oraibi in 1882, when the village was surveyed. A study was made of the constructional devices in use at Oraibi and some of the other villages, and many photographs of interesting features were made. The methods in use here are more primitive than in any other pueblo. They show also less white or Mexican influence, and consequently are valuable as throwing light on primitive architecture.

Two interesting ruins were discovered and surveyed. They were both found upon the west side of the 'Oraibi Wash,' a large valley running north and a little east from Oraibi, from which the ruins are distant seven and fourteen miles respectively. They both occur upon the summits of small buttes detached from, but close to, the

edge of the mesa forming the west side of the valley, and are so situated as to command an extensive view of the valley proper and of one or more of its smaller branches. The buttes are quite similar in character. The summit, in both cases, is of small area, formed of bare rock, almost flat, and breaking off almost continuously around its edge into a ledge eight or ten feet high. The ruins occupy the whole of the summit, and extend down over the slopes, which fall away from the base of the ledge. The ruins themselves are similar in character, and both are directly connected traditionally with Oraibi. The Navajos also have legends concerning them.

In the northern ruin was found an interesting cave, or underground apartment, occurring within the ruin. The entrance was very small, and had been, until recently, carefully concealed. It is said to have been broken open by Navajos in search of ancient pottery. Inside were found some well-built stone walls with supporting timbers, but the cave was too much filled up with dust and *débris* to permit much exploration without excavation, for which both time and means were lacking. A visit was paid to the small village of Moen-Kopi, which is inhabited during the farming season only, and occupies the same relation to Oraibi that Ojo Caliente, Nutria, and Pescado bear to Zuñi, — a sort of outlying settlement or farming pueblo. It is situated on the north side of the Moen-Kopi Wash, which for some distance above and below this point presents an almost vertical wall. Here, however, the cañon wall breaks down into a gentle slope, and a small valley puts out to the north. It is at the junction of this valley with the main cañon that the village is located, about halfway up the slope. In the smaller valley are a number of fine springs, situated some distance above the cañon bottom. These springs probably determined the location of the settlement. The whole of the valley was under cultivation, being irrigated from these springs, as was also a considerable portion of the bottom of the cañon proper, overlooked by the village. Farther down were large fields of corn and wheat. One of the most interesting things to be seen in this vicinity is the cotton-fields. Cotton was grown by these Indians prior to their discovery by the Spaniards, and occupies a very important place in their mythology. It is a sacred plant, and garments or articles of apparel made from it are used only in the sacred ceremonials. At the present time Moen-Kopi is the only place where cotton is grown, but tradition mentions several other localities. Seeds of North Carolina cotton and Maryland water-melons, sent out in 1885, were found to have deteriorated but slightly, though they had passed through two plantings. The cotton is not allowed to ripen on the stalk; but the pods are broken off while yet green, and laid in the sun, upon the roofs of the houses, until they burst open. This village is but fifteen or twenty years old, but has been built on the site of an older settlement.

Subsequently the party spent six weeks at the Chaco ruin. These ruins have been frequently described, and ground plans of some of the larger ones have been published. An accurate survey of the more important ruins was made, and the plans secured reveal many important points. The drawings and descriptions of Simpson and Jackson, made in 1849 and 1877, are of so general a nature as to be misleading. No such symmetry, for example, as that portrayed in their plans, is to be found: in this respect the Chaco ruins are not superior to hundreds of others. The quality of the masonry has also been much exaggerated, though doubtless unintentionally. A close examination revealed great ignorance, on the part of the builders, of some of the simplest principles of construction. Another feature of interest was the very plain evidence of successive or different occupation. In Pueblo Bonito, the largest ruin of the group, three distinct types of construction were found, lapping over and extending into each other. Several ruins not previously known were surveyed, and others were visited. Mr. Morgan attempted to identify the Chaco ruins with the celebrated 'Seven Cities of Cibola;' but the number is nearly seventy, instead of seven. Upon the exposed or south side of the cañon bottom are a great number of ruins which so far have been overlooked, though they are not inferior in extent to the well-preserved specimens under the north cliff; they are, however, almost completely obliterated through the action of the elements. There is no reason to suppose, however, that the ruins on the south side of the cañon bottom are more

ancient than those upon the northern side: their exposed position has simply hastened their destruction.

Late in the season some of the party visited and made a survey of the Pueblo of Jemez, situated upon a creek of the same name, a small tributary of the Rio Grande. An accurate ground plan was made, corresponding in every respect to the plans made in previous years of the pueblos of the Little Colorado.

At various times during the progress of the field-work, opportunities were afforded of making studies of Navajo architecture. These Indians build a house of a rudely conical form, composed of brush and earth upon a supporting framework of timber; and their 'hogans' are of considerable interest, and throw much light on primitive house-construction. While the party was at Keam's Cañon a large number of these houses were examined, under the guidance and with the help of some of the best men in the tribe. No less than five distinct types of structures were found, although the details of construction are minutely prescribed and rigidly adhered to. The 'hogans' always front the east; and the erection of one is an important and a sacred event to those interested, being accompanied by many ceremonial observances and an elaborate ritual.

The material collected during the field-season will be incorporated into reports now being prepared by the Bureau of Ethnology.

EXPLORATIONS IN GREENLAND.

In the year 1886 the Danish Government sent out an expedition for the exploration of the region of Upernivik and Tassiussak, which had hitherto been almost unknown. Lieutenants Ryder and Bloch wintered in Upernivik, and intended to set out early in spring on an expedition northward. Unfortunately the winter proved to be very severe, and the dreaded dog's disease swept away the dogs of the natives, compelling the explorers to start as soon as the increasing daylight permitted, as the dogs were wanted for sealing in April and May. On Feb. 21, 1887, they left Upernivik, and on the following day arrived at Tassiussak, the most northern trading-station. Here they procured a few dogs, and continued their northward journey, the thermometer ranging constantly under the freezing-point of mercury. As the Greenlanders did not build snow-houses, travelling was very difficult, and the explorers as well as their Eskimo companions suffered severely from frost-bites. The difficulties were increased by deep snow; and as no ice-bears were met with, on which the travellers had to rely for dog's food, they were compelled very soon to turn back. The failure of this expedition to reach the northern parts of Melville Bay is to be greatly regretted; but its results show that an exploration of the coast by means of dog-sledge, and early in spring, is not at all difficult.

The travellers reached Upernivik in March, and in April explored the large fiord east of the colony. Here the velocity of the glacier which empties itself into the sea was measured, and found to be thirty-three feet, while in August it amounted to ninety-nine feet in twenty-four hours. This result is very remarkable, as measurements of the southern glaciers show a comparatively uniform velocity throughout the year.

On May 7 the first sign of open water was seen on the western horizon; on May 23 the first whaler made his appearance on the outside islands; but the harbor of Upernivik was not open until June 11. This was considered a late date for the breaking-up of the land-ice on the Greenland coast; while in Melville Bay it lasted well into July or August, and on the west coast of Baffin Bay even until late in August. On June 26 Lieutenants Bloch and Ryder made another start northward with two boats. Their progress was greatly retarded by the prevailing fogs, while drifting icebergs made travelling dangerous. On Aug. 4 they reached their extreme northern point in $74^{\circ} 25'$ north latitude. The sea farther to the northward was covered with ice; and as the homebound vessel, which the travellers were instructed to take at Upernivik, left on Aug. 15, they were obliged to return.

Among the results of this journey one is of great interest, — the fact that even the extreme northern point reached by the expedition is inhabited by Eskimo, who visit it every spring. The most northern native village is Itivliarsuk in $73^{\circ} 30'$ north latitude; but

